REMARKS

Claims 1-12 are pending. The claims have been amended for clarity and to remove redundant claim terms. Support for new Claim 12 is found in Claim 8. No new matter has been added. An action on the merits and allowance of the claims is requested.

The Applicants thank Examiner Cameron for the courteous and helpful interview of December 15, 2005. The Applicants were encouraged to perfect their claim for priority. Approaches for addressing the obviousness rejection were discussed.

Rejection—35 U.S.C. §112, second paragraph

Claims 1-11 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite. These rejections are moot in view of the amendments above.

Objection—Claim 5

Claim 5 was objected to as being in improper dependent form. This objection is now moot.

Rejection—35 U.S.C. §102

Claims 1-8 and 10-11 were rejected under 35 U.S.C. 102(e) as being anticipated by Kobayashi et al., U.S. Patent No. 6,858,312. This rejection is moot in view of the filing of the certified English translation of the priority document which antedates Kobayashi et al. Support for Claims 1-11 appears in the English translation of the priority document as follows:

Claim No.	Section No. of Description
Claim 1:	[0013] to [0030], specifically [0013], [0014], [0015]
Claim 2:	[0034]

Claim 3: [0017], [0018]

Claim 4: [0022]

Claim 5: [0023], [0024]

Claim 6: [0026]

Claim 7: [0031]

Claim 8: [0034]

Claim 9: [0033]

Claim 10: [0034], [0035], [0036]

Claim 11: [0034].

The Bonding Mechanism of Chitosan with Metal Compound and Metal Substrate

The chitosan-metal complexes of the present invention for an insolubilized undercoat. These complexes provide a coating with superior adhesion and anti-corrosive properties compared to conventional substrate treatments, such as the application of chitosan alone or metal compounds alone. Page 21, line 21 through page 23, line 6, of the specification describe bonding mechanisms involving chitosan and metals. The following section reviews these binding mechanisms.

Chitosan contains amino groups and hydroxyl groups in its skeleton and is inherently insoluble in water. Chitosan may be rendered water-soluble by treating it with an acid, such as a carboxylic acid. This converts chitosan into a salt where its amino groups exhibit cationic properties. Water-soluble chitosan can bond with a metal compound to form the composition of the present invention. The cationized amino and/or hydroxy groups of chitosan bind to the metal compound forming a crosslinked chitsoan-metal complex with superior binding and anti-corrosive properties (specification, page 12, lines 21-25).

The superior protective properties of these chitosan-metal complexes are shown in Tables 1-3 on pages 35-37 of the specification. One explanation for these superior properties are the following phenomena:

(1) The cationized amino groups and/or hydroxyl groups of the chitosan-metal compound complex that are not involved in binding to metal compound itself, coordinate to metal atoms on the surface of the metal substrate. The metal component of the chitosan complex is oriented against the side opposite (across the chitosan skeleton) to the surface of the metal substrate. On seeing as a whole the chitosan-metal compound complex, the complexes align the surface of the metal substrate. The chitosan-metal compound complexes in such conditions develop excellent adhesion with the surface of the metal substrate.

(2) When the chitosan-metal compound complexes form a undercoat on the surface of the metal substrate, the metal compounds in the complexes induce a metal-dependent crosslinking reaction via the cationized amino groups and/or hydroxyl groups contained in the skeleton of chitosan of the complex (specification, page 13, lines 21 to 25; page 14, lines 13 to 17; page 15, lines 1 to 13). The product of this metal-dependent crosslinking reaction bonds firmly with the metal substrate via chitosan and provides the metal substrate with excellent corrosion resistance.

(3) The coordination and metal-dependent crosslinking reaction as above induce the formation of an insolubilized undercoat having superior toughness and excellent and firm adhesion.

(4) The bonding of the chitosan-metal compound complex with a metal substrate is primarily based on the coordination and secondary the metal-dependent crosslinking reaction.

The superior properties of the present invention can thus be explained by the combination of chitosan and a metal causing the formation of a crosslinked insolubilized undercoat having higher toughness and excellent adhesion on the metal substrates.

Rejection—35 U.S.C. §103

Claim 9 was rejected under 35 U.S.C. 103(a) as being patentable over Kobayashi et al., U.S. Patent No. 6,858,312. This rejection is moot in view of the filing of the certified English translation of the priority document which antedates Kobayashi et al.

Rejection—35 U.S.C. §103

Claims 1-3 and 5-11 were rejected under 35 U.S.C. 103(a) as being patentable over Wojcik, U.S. Patent No. 6,508,958, in view of the alleged state of the prior art or Terada et al., EP 153973. These documents, as well as the other prior art cited below, do not suggest or provide a reasonable expectation of success for the chitosan-metal complex of the present invention.

Wojcik discloses treating aluminum from corrosion by applying chitosan which has been reacted with a carboxylic acid (Abstract, col. 1, lines 7-11, Claim 1). As stated in the Official Action, Wojcik does not suggest applying a composition of a chitosan and a metal compound as required by the present invention. No metal, no chitosan complex. Therefore, one with ordinary skill in the art would have no expectation of success for the superior properties provided by the chitosan-metal complex of the invention which involve the chemical interaction of these two components.

Page 4, lines 2-19, of the specification are cited as admitting that treatment of metals with metal compounds is known. Terada et al. ('973) is cited as disclosing treating metals, such as galvanized steel with Ti or Zr compounds. However, the cited prior art does not suggest combining a metal compound with a chitosan product. Terada et al. ('973) only refers to a solution containing organosilanes and a Ti fluoride and/or Zr fluoride compound.

No chitosan compound is contained in the solution. Therefore, coordination of cationated amino groups to the surface of metal substrate could not arise at all. Therefore, the benefits of such a coordination complex, such as the formation of an insolubilized undercoat having superior toughness and excellent adhesion, could not be recognized by one with ordinary skill in the art based on any of the cited references.

The Official Action indicates that since acid-treated chitosan (Wojcik) and metal compounds (Terada) were known corrosion inhibitors, that it would have been obvious to use both treatments and expect enhanced corrosion protection. However, the prior art does not suggest how to apply the two coatings. Should the chitosan coating or the metal coating be applied first? Should chitosan and metal be mixed and applied as one coating? There is no guidance at all in the prior art with respect to how to apply or combine these ingredients. One with ordinary skill in the art might well believe that the application of one coating like chitosan might prevent adherence of the second coating or that adding metal to chitosan would bind up or occupy all the metal binding sites on the chitosan preventing its ability to bind effectively to a metal substrate.

In view of this lack of direction, the Applicants submit that, at best, the prior art only provides an "obvious to try" motivation and that there was no reasonable expectation of success for any of the above methods providing superior corrosion resistance and adherence to a metal substrate.

On the other hand, the inventors have discovered that a complex of chitosan and a metal compound when applied to a substrate, such as metal, produces a superior more durable and corrosion-resistant coating. This superior result is attributable to the crosslinked (or coordination) complex formed between the cationic groups on the chitosan and the metal compound. When applied this coordination complex provides a metal substrate with superior adhesion and anti-corrosive properties.

There is no suggestion in any of the cited prior art that combining chitosan and a metal compound would provide a crosslinked or coordination complex that would provide superior anti-corrosion properties. Moreover, one with ordinary skill in the art would not inevitable produce this complex by practicing both prior art methods, because there is no suggestion to combine the chitosan and metal compound prior to application as opposed to first performing the metal (or chitosan) coating step, and then performing the chitosan (or metal) coating step. For example, totally different coatings would result if the chitosan were first applied as disclosed by Wojcik, dried or baked, and then followed by the application of the metal compound.

Moreover, the present inventors have discovered that a coating comprising a chitosan-metal complex provides superior corrosion resistance. The superior properties of the composition of the invention are shown in Examples 1-13 and in Tables 1-3 of the Specification. For example, the coating of Comparative Example 1 (page 35) is glycerated chitosan (no metal) and in Comparative Example 5 the coating is Zr alone (no chitosan).

The results on page 37 show that metal treated with either of these coatings alone localized occurrence of separation (lifting) of the resin coating layer and corrosion under the resin coating layer (B) or occurrence of separation over the entire resin coating (C).

On the other hand, the corresponding combination of glycerated chitosan and Zr of the present invention provided complete corrosion resistance (A/A) as shown by Experimental Example 4 (primer 4, page 26, line 10) provided complete corrosion resistance (A: no change in external appearance). The cited prior does not suggest the combination of chitosan and metal and therefore can not provide a reasonable expectation of success for the superior properties exhibited by the present invention.

Rejection—35 U.S.C. §103

Claim 4 was rejected under 35 U.S.C. 103(a) as being patentable over Wojcik, U.S. Patent No. 6,508,958 taken in view of the alleged state of the prior art or Terada et al., EP 153973, and further in view of Kobayashi et al., U.S. Patent No. 6,858,312. This rejection may be withdrawn for the reasons discussed above. Moreover, it is moot in view of the filing of the certified English translation of the priority document which antedates Kobayashi et al.

Rejection—35 U.S.C. §103

Claims 1-3 and 5-11 were rejected under 35 U.S.C. 103(a) as being patentable over Takazawa, JP 11-293149, in view of the alleged state of the prior art or in view of Terada et al., EP 153973. Takazawa like Wojcik does not disclose or suggest combining chitosan and a metal compound to produce a crosslinked complex with superior coating and anti-corrosion properties. It therefore cannot suggest or provide a reasonable expectation of success for the complex of the present invention and the superior adhesive and anti-corrosive properties provided by this complex. Accordingly, the Applicants respectfully request that this rejection be withdrawn.

Rejection—35 U.S.C. §103

Claim 4 was rejected under 35 U.S.C. 103(a) as being patentable over JP 11-293149 taken in view of the alleged state of the prior art or EP 153,973, and further in view of Kobayashi et al., U.S. Patent No. 6,858,312. This rejection may be withdrawn for the reasons discussed above with respect to JP 11-293149 and EP153973. Moreover, it is moot in view of the filing of the certified English translation of the priority document which antedates Kobayashi et al.

Rejection—35 U.S.C. §103

Claims 1-3 and 5-11 were rejected under 35 U.S.C. 103(a) as being patentable over El-Sawy et al., in view of the alleged state of the prior art or in view of Terada et al., EP 153,973. El-Sawy et al. like Wojcik above do not disclose the combination of chitosan and a metal. It therefore cannot suggest or provide a reasonable expectation of success for the complex of the present invention and the superior adhesive and anti-corrosive properties provided by this complex. Accordingly, the Applicants respectfully request that this rejection be withdrawn.

CONCLUSION

In view of the above amendments and remarks, the Applicants submit that this application is now in condition for allowance. An early notification to that effect is earnestly solicited.

Respectfully submitted,

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